

NATIONAL WEATHER SERVICE
SERVICE DESCRIPTION DOCUMENT (SDD)
TYPE: Experimental Product
DATE: November 23, 2007

National Digital Forecast Database
Web Feature Service

Part 1 – Mission Connection

- Product/Service Description:** National Digital Forecast Database (NDFD) Web Feature Service (WFS) is a service for providing the public, government agencies, and commercial enterprises another way to access the National Weather Service's (NWS) digital forecast database. The service allows the user to retrieve NDFD elements using Open Geospatial Consortium (OGC) standards. These industry standard interface specifications are open source and have been widely adopted by the geospatial community. More information about the NDFD WFS is available at the following URL:

http://www.weather.gov/forecasts/xml/OGC_services/

An NWS customer's WFS client can access the NDFD WFS at the following web address:

http://www.weather.gov/forecasts/xml/OGC_services/ndfdOWSserver.php?SERVICE=WFS&Request=GetCapabilities

Users can explore the service using the following URL (requires at least Internet Explorer 5 or Netscape 6):

http://www.weather.gov/forecasts/xml/OGC_services/ndfdOGC_services.htm

The WFS returns NDFD data wrapped in a dialect of Extensible Markup Language (XML) called Geography Markup Language (GML). GML is an OGC standard for encoding geospatial data. The service's application schema is shown in Appendix C and is available at the following web addresses:

http://www.weather.gov/forecasts/xml/OGC_services/ndfdOWSserver.php?SERVICE=WFS&Request=DescribeFeatureType&VERSION=1.0.0&TYPENAME=Forecast_Gml2Point

http://www.weather.gov/forecasts/xml/OGC_services/ndfdOWSserver.php?SERVICE=WFS&Request=DescribeFeatureType&VERSION=1.1.0&TYPENAME=Forecast_GmlsfPoint,Forecast_GmlObs,NdfdMultiPointCoverage

The service also returns NDFD data wrapped in a second dialect of XML known as Keyhole Markup Language (KML). KML, an OGC best practice, is a standard understood by a number of applications that process geospatial data. More information on KML is available at the following URL:

<http://code.google.com/apis/kml/documentation/whatiskml.html>

The weather parameters distributed by the WFS are the same as those in the NDFD. A list of NDFD elements and a description of NDFD data, including weather element temporal and spatial resolution, is available at the following URL:

<http://www.nws.noaa.gov/ndfd/technical.htm>

2. **Purpose/Intended Use:** The NDFD WFS will allow NWS customers to maximize the economic value of NDFD data by making it available in a convenient and understandable form. WFS and GML are widely accepted OGC standards for geospatial data exchange via the internet. Additionally, WFS, GML, and KML are commonly used in geographical information systems (GIS) that can add value to, and assist decision makers with extracting information from, NWS forecasts. The NDFD WFS allows machine-to-machine distribution of NWS data (figure 1). This automated access will make the process of learning about the data and integrating it into user operations more efficient.

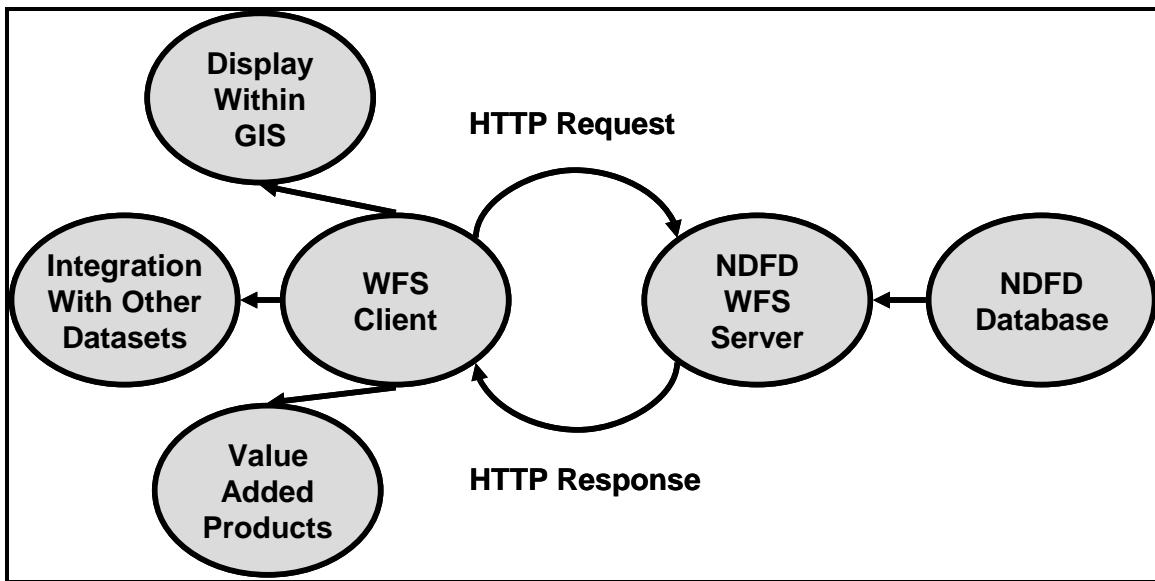


Figure 1: NDFD WFS Data Flow

By virtue of its support of machine-to-machine transfer and reliance on the GML and KML standards, NDFD WFS supports the *National Weather Service*

Strategic Plan for FY2005 – FY2010 by contributing to “...evolving our services from a text-based paradigm to one based on making NWS information available quickly, efficiently, and in convenient and understandable forms (e.g., National Digital Forecast Database and GIS)...” and “...by taking advantage of existing and emerging technologies to disseminate this information...”

3. **Audience:** NDFD WFS is intended primarily for GIS users requiring the weather information contained in the NDFD. These users represent members of the public, government agencies, and private sector entities.
4. **Presentation Format:** The service organizes NDFD information as a stream of character data sent over the internet. These characters represent the XML elements and attributes and the NDFD data they wrap. A sample of NDFD GML, referred to as Digital Weather GML (dwGML), is contained in Appendix A. A sample of NDFD data wrapped in KML is found in Appendix B. DwGML conforms to the service application schema in Appendix C.
5. **Feedback Method:** Users of NDFD WFS are encouraged to provide feedback using the Customer Survey for Experimental Products/Services (<http://www.weather.gov/survey/nws-survey.php?code=ndfd-wfs>). Instead of completing the survey on-line, it can be e-mailed to nws.xml@noaa.gov or mailed to the following address:

Meteorological Development Laboratory
Attn: John Schattel, W/OST24
1325 East-West Highway, SSMC2
Silver Spring, MD 20910

Comments and feedback on the NDFD WFS will be accepted through April 30, 2008.

Part 2 – Technical

1. **Format and Science Basis:** Strictly speaking, dwGML and KML have no format. This is one of the underlying principles of XML that formatting information has been removed from a document leaving only content. However, the elements and attributes that can appear in a dwGML and KML document and their order are restricted. These constraints, which constitute dwGML’s vocabulary and grammar, are defined in its application schema (Appendix C). The KML schema is available on line at <http://code.google.com/apis/kml/schema/kml21.xsd>. These schemas are used in conjunction with a [validator](#) to ensure the XML adheres to the language’s specification. This conformance with an agreed to specification allows a user to [parse](#) the document in order to make use of the data it contains.

A technical description of the NDFD data contained in the dwGML and KML is available at <http://www.nws.noaa.gov/ndfd/technical.htm>.

2. **Availability:** The NDFD WFS is continuously available from the NWS web site at the following URL:

http://www.weather.gov/forecasts/xml/OGC_services/ndfdOWSserver.php?SERVICE=WFS&Request=GetCapabilities

The NDFD data that gets wrapped in dwGML and KML is updated at the local Weather Forecast Offices and selected National Centers on an event-driven basis. The updated information is then uploaded to the NDFD server shortly after the top of each hour.

The NDFD WFS is implemented using the HyperText Protocol Get method. This and other information about the service is available in the capabilities document found at the following URL:

http://www.weather.gov/forecasts/xml/OGC_services/ndfdOWSserver.php?SERVICE=WFS&Request=GetCapabilities

3. **Additional Information:** The following tools and references are provided to assist developers wishing to make use of NDFD WFS:

OGC WFS Specification

<http://www.opengeospatial.org/standards/wfs>

GML Specification

<http://www.opengeospatial.org/standards/gml>

KML Specification

http://code.google.com/apis/kml/documentation/kml_tags_21.html

W3C XML Recommendation:

<http://www.w3.org/XML/>

W3C XML Validator

<http://www.w3.org/2001/03/webdata/xsv>

Information on XML parsers

<http://www.google.com/search?q=XML+parser>

Appendix A

Sample dwGML

This example of dwGML was generated by submitting a request to the following URL:
http://www.weather.gov/forecasts/xml/OGC_services/ndfdOGC_services.htm

```
<?xml version="1.0" encoding="UTF-8"?>
<app:NdfdForecastCollection
  xmlns="http://www.weather.gov/forecasts/xml/OGC_services"
  xmlns:app="http://www.weather.gov/forecasts/xml/OGC_services"
  xmlns:ows="http://www.opengis.net/ows"
  xmlns:ogc="http://www.opengis.net/ogc"
  xmlns:wfs="http://www.opengis.net/wfs"
  xmlns:gml="http://www.opengis.net/gml"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.weather.gov/forecasts/xml/OGC_services
    http://weather.gov/forecasts/xml/OGC_services/schema/dwGML_WFS_GMLv212.xsd">

  <gml:boundedBy>
    <gml:Box srsName="WGS84">
      <gml:coordinates>-77.99,38.99 -77.99,38.99</gml:coordinates>
    </gml:Box>
  </gml:boundedBy>
  <gml:featureMember>
    <app:Forecast_Gml2Point>
      <gml:position>
        <gml:Point srsName="WGS84">
          <gml:coordinates>-77.99,38.99</gml:coordinates>
        </gml:Point>
      </gml:position>
      <app:validTime>2007-01-05T23:00:00</app:validTime>
      <app:maximumTemperature>62</app:maximumTemperature>
    </app:Forecast_Gml2Point>
  </gml:featureMember>
</app:NdfdForecastCollection>
```

Appendix B

Sample NDFD KML

This example of KML was generated by submitting a request to the following URL:
http://www.weather.gov/forecasts/xml/OGC_services/ndfdOGC_services.htm

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://earth.google.com/kml/2.1">
  <Folder>
    <name>National Digital Forecast Database (NDFD) Data</name>
    <open>1</open>
    <Document>
      <name>MaximumTemperature</name>
      <open>1</open>
      <Schema parent="Placemark" name="MaximumTemperature">
        <SimpleField type="wstring" name="UOM"></SimpleField>
        <SimpleField type="wstring" name="ValidTime"></SimpleField>
        <SimpleField type="double" name="MaximumTemperature"></SimpleField>
      </Schema>
      <MaximumTemperature>
        <name>MaximumTemperature</name>
        <description>45.0 Fahrenheit valid at 2007-11-08T23:00:00Z</description>
        <Point>
          <coordinates>-77.99,38.99</coordinates>
        </Point>
        <UOM>Fahrenheit</UOM>
        <ValidTime>2007-11-08T23:00:00Z</ValidTime>
        <MaximumTemperature>45.0</MaximumTemperature>
      </MaximumTemperature>
    </Document>
  </Folder>
</kml>
```

Appendix C

NDFD dwGML SCHEMA

This dwGML application schema is compliant with the GML2.1.2 specification and can be found at the following URL:

http://www.weather.gov/forecasts/xml/OGC_services/ndfdOWSserver.php?SERVICE=WFS&Request=DescribeFeatureType&VERSION=1.0.0&TYPENAME=Forecast_Gml2Point

```
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema targetNamespace="http://www.weather.gov/mdl/survey/pgb_survey/dev/OGC_services"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:app="http://www.weather.gov/mdl/survey/pgb_survey/dev/OGC_services"
xmlns:gml="http://www.opengis.net/gml"
elementFormDefault="qualified" version="1.0">

<xsd:import namespace="http://www.opengis.net/gml" schemaLocation="http://schemas.opengis.net/gml/2.1.2/feature.xsd" />

<xsd:element name="NdfdForecastCollection" type="app:NdfdForecastCollectionType" substitutionGroup="gml:_FeatureCollection" />

<xsd:complexType name="NdfdForecastCollectionType">
  <xsd:complexContent>
    <xsd:extension base="gml:AbstractFeatureCollectionType" />
  </xsd:complexContent>
</xsd:complexType>

<xsd:element name="Forecast_Gml2Point" type="app:Forecast_Gml2PointType" substitutionGroup="gml:_Feature" />

<xsd:complexType name="Forecast_Gml2PointType">
  <xsd:complexContent>
    <xsd:extension base="gml:AbstractFeatureType">
      <xsd:sequence>
        <xsd:element ref="gml:position" />
        <xsd:element name="validTime" type="xsd:dateTime" />
        <xsd:element name="maximumTemperature" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
        <xsd:element name="minimumTemperature" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
        <xsd:element name="temperature" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
        <xsd:element name="dewpointTemperature" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
        <xsd:element name="apparentTemperature" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
        <xsd:element name="rainAmount6Hourly" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
        <xsd:element name="snowAmount6Hourly" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
        <xsd:element name="prob0fPrecip12hourly" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
        <xsd:element name="probTCWindSpeedOver34Inc" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
        <xsd:element name="probTCWindSpeedOver50Inc" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
        <xsd:element name="probTCWindSpeedOver64Inc" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
```



```

<xsd:element name="probOfTemperatureBelowJulAugSep" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
<xsd:element name="probOfTemperatureBelowAugSepOct" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
<xsd:element name="probOfTemperatureBelowSepOctNov" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
<xsd:element name="probOfTemperatureBelowOctNovDec" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
<xsd:element name="probOfTemperatureBelowNovDecJan" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
<xsd:element name="probOfTemperatureBelowDecJanFeb" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
</xsd:choice>
<xsd:element name="probOfPrecipitationAboveDay814" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
<xsd:element name="probOfPrecipitationBelowDay814" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
<xsd:element name="probOfPrecipitationAbove1Month" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
<xsd:element name="probOfPrecipitationBelow1Month" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
<xsd:choice minOccurs="0" maxOccurs="12">
    <xsd:element name="probOfPrecipitationAboveJanFebMar" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationAboveFebMarApr" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationAboveMarAprMay" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationAboveAprMayJun" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationAboveMayJunJul" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationAboveJunJulAug" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationAboveJulAugSep" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationAboveAugSepOct" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationAboveSepOctNov" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationAboveOctNovDec" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationAboveNovDecJan" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationAboveDecJanFeb" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
</xsd:choice>
<xsd:choice minOccurs="0" maxOccurs="12">
    <xsd:element name="probOfPrecipitationBelowJanFebMar" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationBelowFebMarApr" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationBelowMarAprMay" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationBelowAprMayJun" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationBelowMayJunJul" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationBelowJunJulAug" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationBelowJulAugSep" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationBelowAugSepOct" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationBelowSepOctNov" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationBelowOctNovDec" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationBelowNovDecJan" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
    <xsd:element name="probOfPrecipitationBelowDecJanFeb" type="xsd:decimal" minOccurs="0" maxOccurs="1" />
</xsd:choice>
</xsd:sequence>
</xsd:extension>
</xsd:complexContent>
</xsd:complexType>
</xsd:schema>

```

This dwGML application schema is compliant with the GML3.1.1 specification and can be found at the following URL:

http://www.weather.gov/forecasts/xml/OGC_services/ndfdOWSserver.php?SERVICE=WFS&Request=DescribeFeatureType&VERSION=1.1.0&TYPENAME=Forecast_GmlsfPoint,Forecast_GmlObs,NdfdMultiPointCoverage

```
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema targetNamespace="http://www.weather.gov/mdl/survey/pgb_survey/dev/OGC_services"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:app="http://www.weather.gov/mdl/survey/pgb_survey/dev/OGC_services"
xmlns:gml="http://www.opengis.net/gml"
xmlns:gmlsf="http://www.opengis.net/gmlsf"
elementFormDefault="qualified" version="2.06">

<xsd:import namespace="http://www.opengis.net/gml"           schemaLocation="http://schemas.opengis.net/gml/3.1.1/base/gml.xsd" />
<xsd:import namespace="http://www.opengis.net/gmlsf"
schemaLocation="http://schemas.opengis.net/gml/3.1.1/profiles/gmlsfProfile/1.0.0/gmlsfLevels.xsd" />

<xsd:element name="NdfdForecastCollection" type="app:NdfdForecastCollectionType" substitutionGroup="gml:_GML" />

<xsd:complexType name="NdfdForecastCollectionType">
  <xsd:complexContent>
    <xsd:extension base="gml:AbstractFeatureType">
      <xsd:sequence minOccurs="0" maxOccurs="unbounded">
        <xsd:element name="featureMember">
          <xsd:complexType>
            <xsd:sequence>
              <xsd:element ref="gml:_Feature" />
            </xsd:sequence>
          </xsd:complexType>
        </xsd:element>
      </xsd:sequence>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>

<xsd:element name="maximumTemperature" type="gml:MeasureType" />
<xsd:element name="minimumTemperature" type="gml:MeasureType" />
<xsd:element name="temperature" type="gml:MeasureType" />
<xsd:element name="dewpointTemperature" type="gml:MeasureType" />
<xsd:element name="apparentTemperature" type="gml:MeasureType" />
<xsd:element name="rainAmount6Hourly" type="gml:MeasureType" />
<xsd:element name="snowAmount6Hourly" type="gml:MeasureType" />
<xsd:element name="probOfPrecip12hourly" type="gml:MeasureType" />
<xsd:element name="probTCWindSpeedOver34Inc" type="gml:MeasureType" />
<xsd:element name="probTCWindSpeedOver50Inc" type="gml:MeasureType" />
<xsd:element name="probTCWindSpeedOver64Inc" type="gml:MeasureType" />
<xsd:element name="probTCWindSpeedOver34Cum" type="gml:MeasureType" />
```

```
<xsd:element name="probTCWindSpeedOver50Cum" type="gml:MeasureType" />
<xsd:element name="probTCWindSpeedOver64Cum" type="gml:MeasureType" />
<xsd:element name="windSpeed" type="gml:MeasureType" />
<xsd:element name="windGust" type="gml:MeasureType" />
<xsd:element name="windDirection" type="gml:MeasureType" />
<xsd:element name="skyCover" type="gml:MeasureType" />
<xsd:element name="relativeHumidity" type="gml:MeasureType" />
<xsd:element name="waveHeight" type="gml:MeasureType" />
<xsd:element name="weatherPhrase" type="gml:MeasureType" />
<xsd:element name="weatherCoverage" type="gml:MeasureType" />
<xsd:element name="weatherIntensity" type="gml:MeasureType" />
<xsd:element name="weatherType" type="gml:MeasureType" />
<xsd:element name="weatherQualifier" type="gml:MeasureType" />
<xsd:element name="weatherVisibility" type="gml:MeasureType" />
<xsd:element name="weatherIcon" type="xsd:anyURI" />
<xsd:element name="convectiveOutlook" type="xsd:string" />
<xsd:element name="probOfTornadoes" type="gml:MeasureType" />
<xsd:element name="probOfHail" type="gml:MeasureType" />
<xsd:element name="probOfDamagingWinds" type="gml:MeasureType" />
<xsd:element name="probOfExtremeTornadoes" type="gml:MeasureType" />
<xsd:element name="probOfExtremeHail" type="gml:MeasureType" />
<xsd:element name="probOfExtremeWinds" type="gml:MeasureType" />
<xsd:element name="probOfSevereThunderstorms" type="gml:MeasureType" />
<xsd:element name="probOfExtremeSevereThunderstorms" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureAboveDay814" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureBelowDay814" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureAbove1Month" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureBelow1Month" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureAboveJanFebMar" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureAboveFebMarApr" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureAboveMarAprMay" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureAboveAprMayJun" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureAboveMayJunJul" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureAboveJunJulAug" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureAboveJulAugSep" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureAboveAugSepOct" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureAboveSepOctNov" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureAboveOctNovDec" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureAboveNovDecJan" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureAboveDecJanFeb" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureBelowJanFebMar" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureBelowFebMarApr" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureBelowMarAprMay" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureBelowAprMayJun" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureBelowMayJunJul" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureBelowJunJulAug" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureBelowJulAugSep" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureBelowAugSepOct" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureBelowSepOctNov" type="gml:MeasureType" />
```

```

<xsd:element name="probOfTemperatureBelowOctNovDec" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureBelowNovDecJan" type="gml:MeasureType" />
<xsd:element name="probOfTemperatureBelowDecJanFeb" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationAboveDay814" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationBelowDay814" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationAbove1Month" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationBelow1Month" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationAboveJanFebMar" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationAboveFebMarApr" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationAboveMarAprMay" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationAboveAprMayJun" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationAboveMayJunJul" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationAboveJunJulAug" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationAboveJulAugSep" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationAboveAugSepOct" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationAboveSepOctNov" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationAboveOctNovDec" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationAboveNovDecJan" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationAboveDecJanFeb" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationBelowJanFebMar" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationBelowFebMarApr" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationBelowMarAprMay" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationBelowAprMayJun" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationBelowMayJunJul" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationBelowJunJulAug" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationBelowJulAugSep" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationBelowAugSepOct" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationBelowSepOctNov" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationBelowOctNovDec" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationBelowNovDecJan" type="gml:MeasureType" />
<xsd:element name="probOfPrecipitationBelowDecJanFeb" type="gml:MeasureType" />

<xsd:complexType name="NDFD_QuantityListType">
  <xsd:simpleContent>
    <xsd:extension base="gml:MeasureOrNullListType" />
  </xsd:simpleContent>
</xsd:complexType>

<xsd:complexType name="NDFD_CategoryListType">
  <xsd:simpleContent>
    <xsd:extension base="gml:CodeOrNullListType" />
  </xsd:simpleContent>
</xsd:complexType>

<xsd:element name="MaximumTemperature" type="app:NDFD_QuantityListType" substitutionGroup="gml:QuantityList" />
<xsd:element name="MinimumTemperature" type="app:NDFD_QuantityListType" substitutionGroup="gml:QuantityList" />
<xsd:element name="ProbOfPrecip12hourly" type="app:NDFD_QuantityListType" substitutionGroup="gml:QuantityList" />
<xsd:element name="RelativeHumidity" type="app:NDFD_QuantityListType" substitutionGroup="gml:QuantityList" />

```



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<xsd:element ref="app:rainAmount6Hourly"
<xsd:element ref="app:snowAmount6Hourly"
<xsd:element ref="app:probOfPrecip12hourly"
<xsd:element ref="app:probTCWindSpeedOver34Inc"
<xsd:element ref="app:probTCWindSpeedOver50Inc"
<xsd:element ref="app:probTCWindSpeedOver64Inc"
<xsd:element ref="app:probTCWindSpeedOver34Cum"
<xsd:element ref="app:probTCWindSpeedOver50Cum"
<xsd:element ref="app:probTCWindSpeedOver64Cum"
<xsd:element ref="app:windSpeed"
<xsd:element ref="app:windGust"
<xsd:element ref="app:windDirection"
<xsd:element ref="app:skyCover"
<xsd:element ref="app:relativeHumidity"
<xsd:element ref="app:waveHeight"
<xsd:element ref="app:weatherCoverage"
<xsd:element ref="app:weatherIntensity"
<xsd:element ref="app:weatherType"
<xsd:element ref="app:weatherQualifier"
<xsd:element ref="app:weatherVisibility"
<xsd:element ref="app:weatherIcon"
<xsd:element ref="app:convectiveOutlook"
<xsd:element ref="app:probOfTornadoes"
<xsd:element ref="app:probOfHail"
<xsd:element ref="app:probOfDamagingWinds"
<xsd:element ref="app:probOfExtremeTornadoes"
<xsd:element ref="app:probOfExtremeHail"
<xsd:element ref="app:probOfExtremeWinds"
<xsd:element ref="app:probOfSevereThunderstorms"
<xsd:element ref="app:probOfExtremeSevereThunderstorms"
<xsd:element ref="app:probOfTemperatureAboveDay814"
<xsd:element ref="app:probOfTemperatureBelowDay814"
<xsd:element ref="app:probOfTemperatureAbove1Month"
<xsd:element ref="app:probOfTemperatureBelow1Month"
<xsd:choice minOccurs="0" maxOccurs="12">
    <xsd:element ref="app:probOfTemperatureAboveJanFebMar" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfTemperatureAboveFebMarApr" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfTemperatureAboveMarAprMay" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfTemperatureAboveAprMayJun" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfTemperatureAboveMayJunJul" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfTemperatureAboveJunJulAug" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfTemperatureAboveJulAugSep" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfTemperatureAboveAugSepOct" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfTemperatureAboveSepOctNov" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfTemperatureAboveOctNovDec" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfTemperatureAboveNovDecJan" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfTemperatureAboveDecJanFeb" minOccurs="0" maxOccurs="1" />
</xsd:choice>
<xsd:choice minOccurs="0" maxOccurs="12">

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<xsd:element ref="app:probOfTemperatureBelowJanFebMar" minOccurs="0" maxOccurs="1" />
<xsd:element ref="app:probOfTemperatureBelowFebMarApr" minOccurs="0" maxOccurs="1" />
<xsd:element ref="app:probOfTemperatureBelowMarAprMay" minOccurs="0" maxOccurs="1" />
<xsd:element ref="app:probOfTemperatureBelowAprMayJun" minOccurs="0" maxOccurs="1" />
<xsd:element ref="app:probOfTemperatureBelowMayJunJul" minOccurs="0" maxOccurs="1" />
<xsd:element ref="app:probOfTemperatureBelowJunJulAug" minOccurs="0" maxOccurs="1" />
<xsd:element ref="app:probOfTemperatureBelowJulAugSep" minOccurs="0" maxOccurs="1" />
<xsd:element ref="app:probOfTemperatureBelowAugSepOct" minOccurs="0" maxOccurs="1" />
<xsd:element ref="app:probOfTemperatureBelowSepOctNov" minOccurs="0" maxOccurs="1" />
<xsd:element ref="app:probOfTemperatureBelowOctNovDec" minOccurs="0" maxOccurs="1" />
<xsd:element ref="app:probOfTemperatureBelowNovDecJan" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfTemperatureBelowDecJanFeb" minOccurs="0" maxOccurs="1" />
</xsd:choice>
<xsd:element ref="app:probOfPrecipitationAboveDay814" minOccurs="0" maxOccurs="1" />
<xsd:element ref="app:probOfPrecipitationBelowDay814" minOccurs="0" maxOccurs="1" />
<xsd:element ref="app:probOfPrecipitationAbovelMonth" minOccurs="0" maxOccurs="1" />
<xsd:element ref="app:probOfPrecipitationBelowlMonth" minOccurs="0" maxOccurs="1" />
<xsd:choice minOccurs="0" maxOccurs="12">
    <xsd:element ref="app:probOfPrecipitationAboveJanFebMar" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationAboveFebMarApr" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationAboveMarAprMay" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationAboveAprMayJun" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationAboveMayJunJul" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationAboveJunJulAug" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationAboveJulAugSep" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationAboveAugSepOct" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationAboveSepOctNov" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationAboveOctNovDec" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationAboveNovDecJan" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationAboveDecJanFeb" minOccurs="0" maxOccurs="1" />
</xsd:choice>
<xsd:choice minOccurs="0" maxOccurs="12">
    <xsd:element ref="app:probOfPrecipitationBelowJanFebMar" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationBelowFebMarApr" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationBelowMarAprMay" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationBelowAprMayJun" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationBelowMayJunJul" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationBelowJunJulAug" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationBelowJulAugSep" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationBelowAugSepOct" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationBelowSepOctNov" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationBelowOctNovDec" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationBelowNovDecJan" minOccurs="0" maxOccurs="1" />
    <xsd:element ref="app:probOfPrecipitationBelowDecJanFeb" minOccurs="0" maxOccurs="1" />
</xsd:choice>
</xsd:sequence>
</xsd:extension>
</xsd:complexContent>
</xsd:complexType>

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<xsd:element name="Forecast_GmlObs" substitutionGroup="gml:Observation" />

<xsd:element name="ForecastValue" substitutionGroup="gml:_GML">
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    <xsd:complexContent>
      <xsd:extension base="gml:AbstractGMLType">
        <xsd:sequence>
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          <xsd:element ref="app:minimumTemperature" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:temperature" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:dewpointTemperature" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:apparentTemperature" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:rainAmount6Hourly" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:snowAmount6Hourly" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:probOfPrecip12hourly" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:probTCWindSpeedOver34Inc" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:probTCWindSpeedOver50Inc" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:probTCWindSpeedOver64Inc" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:probTCWindSpeedOver34Cum" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:probTCWindSpeedOver50Cum" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:probTCWindSpeedOver64Cum" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:windSpeed" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:windGust" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:windDirection" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:skyCover" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:relativeHumidity" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:waveHeight" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:weatherCoverage" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:weatherIntensity" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:weatherType" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:weatherQualifier" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:weatherVisibility" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:weatherIcon" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:convectiveOutlook" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:probOfTornadoes" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:probOfHail" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:probOfDamagingWinds" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:probOfExtremeTornadoes" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:probOfExtremeHail" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:probOfExtremeWinds" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:probOfSevereThunderstorms" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:probOfExtremeSevereThunderstorms" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:probOfTemperatureAboveDay814" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:probOfTemperatureBelowDay814" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:probOfTemperatureAbove1Month" minOccurs="0" maxOccurs="1" />
          <xsd:element ref="app:probOfTemperatureBelow1Month" minOccurs="0" maxOccurs="1" />
          <xsd:choice minOccurs="0" maxOccurs="12">
            <xsd:element ref="app:probOfTemperatureAboveJanFebMar" minOccurs="0" maxOccurs="1" />
            <xsd:element ref="app:probOfTemperatureAboveAprMayJun" minOccurs="0" maxOccurs="1" />
            <xsd:element ref="app:probOfTemperatureAboveJulAugSep" minOccurs="0" maxOccurs="1" />
            <xsd:element ref="app:probOfTemperatureAboveOctNovDec" minOccurs="0" maxOccurs="1" />
            <xsd:element ref="app:probOfTemperatureBelowJanFebMar" minOccurs="0" maxOccurs="1" />
            <xsd:element ref="app:probOfTemperatureBelowAprMayJun" minOccurs="0" maxOccurs="1" />
            <xsd:element ref="app:probOfTemperatureBelowJulAugSep" minOccurs="0" maxOccurs="1" />
            <xsd:element ref="app:probOfTemperatureBelowOctNovDec" minOccurs="0" maxOccurs="1" />
            <xsd:element ref="app:probOfTemperatureAbove12Month" minOccurs="0" maxOccurs="1" />
            <xsd:element ref="app:probOfTemperatureBelow12Month" minOccurs="0" maxOccurs="1" />
            <xsd:element ref="app:probOfTemperatureAbove18Month" minOccurs="0" maxOccurs="1" />
            <xsd:element ref="app:probOfTemperatureBelow18Month" minOccurs="0" maxOccurs="1" />
            <xsd:element ref="app:probOfTemperatureAbove24Month" minOccurs="0" maxOccurs="1" />
            <xsd:element ref="app:probOfTemperatureBelow24Month" minOccurs="0" maxOccurs="1" />
          </xsd:choice>
        </xsd:sequence>
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>
</xsd:element>

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```
<xsd:element ref="app:probOfPrecipitationBelowMayJunJul" minOccurs="0" maxOccurs="1" />
<xsd:element ref="app:probOfPrecipitationBelowJunJulAug" minOccurs="0" maxOccurs="1" />
<xsd:element ref="app:probOfPrecipitationBelowJulAugSep" minOccurs="0" maxOccurs="1" />
<xsd:element ref="app:probOfPrecipitationBelowAugSepOct" minOccurs="0" maxOccurs="1" />
<xsd:element ref="app:probOfPrecipitationBelowSepOctNov" minOccurs="0" maxOccurs="1" />
<xsd:element ref="app:probOfPrecipitationBelowOctNovDec" minOccurs="0" maxOccurs="1" />
<xsd:element ref="app:probOfPrecipitationBelowNovDecJan" minOccurs="0" maxOccurs="1" />
<xsd:element ref="app:probOfPrecipitationBelowDecJanFeb" minOccurs="0" maxOccurs="1" />
</xsd:choice>
</xsd:sequence>
</xsd:extension>
</xsd:complexType>
</xsd:element>
<xsd:element name="NdfdMultiPointCoverage" type="app:NdfdMultiPointCoverageType" substitutionGroup="gml:_DiscreteCoverage" />
<xsd:complexType name="NdfdMultiPointCoverageType">
<xsd:complexContent>
<xsd:extension base="gml:MultiPointCoverageType">
<xsd:sequence>
<xsd:element name="validTime" type="xsd:dateTime" />
</xsd:sequence>
</xsd:extension>
</xsd:complexContent>
</xsd:complexType>
</xsd:schema>
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